

REMARKS

This response follows the sequence of the Office Action dated 10/14/2004, and, where practicable, is numbered identically.

Response to Paragraph 1 -- Specification

The Examiner is asked to withdraw objections in view of corrections made and these Remarks:

a/b/c/d Typo corrections appear in context in replacement following subhead **Operation** for page 6 of written description, for misspelled words ***imaged*** and ***plate***. The following statement has been placed at the end of the first full paragraph:

of yaw vacuum diffuser bracket 5. Note that adjustments in theta, x and y are controlled respectively by theta, x and y adjustment screws, respectively numbered 12, 28 and 29, counteracted by preload springs. Two x preload springs 10 and two y preload springs 17 appear in Fig. 4. Assembly items such as clamp 15 and post 16 in Figs. 1 and 3 hold parts in

place generally, while allowing the small sliding motions of adjustment, and may be accessed from above through reliefs in overlying planes.

There is no new matter because all elements have been included from first filing, both in text and in drawings.

There are also small corrections made in the Steps under subhead **Manufacture**, to add missing reference characters and part designations.

There is no new matter because all elements have been included from first filing, both in text (see especially page 6, second full paragraph) and in drawings.

Note that spring-preloaded adjustment screws are well known. Note also the first stated object of this invention "...to make possible a high-resolution projection imaging operation on a large substrate with height additions significantly less than the optical space between projection optics and scanning stage." Systems to perform such projection imaging operations typically are very costly, require extraordinarily stable bridge supports for the optics, and are limited both by bridge height and lens optical path length to a small vertical space. (See original text, page 2, first full paragraph, and in the single full paragraph under the heading FIELD OF THE INVENTION.) The demand is for

an alignable, low-profile substrate chuck. This invention crams three degrees of freedom into a very flat package for easy handling, retaining full adjustability of alignment and maintaining resolution.

Note also the entire fourteen-line summary on page 8 as filed, which summarizes the inventive solution to the need for a low-profile substrate chuck to increase the effective range of the stage platform and provide high-resolution alignment motions in x, y and theta – all in a very limited vertical space.

Response to Paragraph 2 -- **Drawings**

The Examiner is asked to accept the enclosed set of corrected drawings. A marked copy set of drawings indicates corrections in red. Note that some objections to drawings cured by reference characters are further resolved by part designations added by amendment to written description and claims for which replacement pages are supplied.

i. A high-resolution stage 19, with its top surface 21 now marked by designation “S,” now appears in Fig. 2. Such high-resolution stages are devices sold as such, and are typically used in microelectronics imaging systems. Note that the high-resolution stage is not positively stated as an element in any claim, but is mentioned in the preamble of claim 1 as context. Another mention, again in context, has been deleted at the end of claim 1. Again in context, the stage is mentioned in several dependent claims where claim features make possible various adjustments of alignment while so mounted. To make clear that the stage is not positively mentioned as an element of invention embodiment construction, but rather mentioned as a mounting location context, the term “such” now is used rather than the confusing term “said.” Counsel apologizes for the confusion.

ii. The central yaw shaft opening, which has continuously appeared in Figs. 1-5 as filed, is now identified with reference character 22 in Fig. 3.

iii. A vacuum distribution channel pattern has appeared from first filing in Figs. 1 and 2. This vacuum distribution channel pattern is now identified by

reference characters 23 in Figs. 1 and 2. Yaw vacuum diffuser bracket 5 supports vacuum diffuser plate 7 on the tops of diffuser plate support islands 14. Vacuum paths around diffuser plate support islands 14 include representative channels in vacuum channel pattern 23 shown in Figs. 1-3. .

There is no new matter because this vacuum distribution channel pattern has been shown in the original figures and because "...vacuum distribution..." appears in the claims as originally filed and vacuum distribution is discussed at length. See, for example, page 8, line 14.

iiii. .Counsel apologizes for confusion of terms. The term "channel" should not have been used for both vacuum distribution and for the relief cut into yaw vacuum diffuser bracket 5. Yaw vacuum diffuser bracket 5 forms a coplanar apron around vacuum diffuser plate 7, providing further support to any substrate mounted for vacuum lock to the vacuum diffuser plate 7. Yaw vacuum diffuser bracket 5 has a peripheral vacuum diffuser plate locating relief 25 cut to the proper configuration and depth to hold vacuum diffuser plate 7 in place and with its top surface coplanar with the apron formed by the top surface of yaw vacuum

diffuser bracket 5. This is the relationship pointed out in Claim 1, clause g. The term “peripheral channel” in clause g of claim 1 has been changed to “peripheral diffuser plate locating relief” to avoid confusion of terms.

There is no new matter because the original drawings showed, and the original text described, the relationship of the top surfaces of yaw vacuum diffuser bracket 5 and vacuum diffuser plate 7.

v. Claim 5 has been amended to specify that the x pre-load means is separate from the y-preload means. This eliminates the confusion pointed out by the Examiner -- whether the x and y pre-load means are separate or combined. Claim 1, the broader parent claim, would cover either situation – separate or combined.. Since claim 5 is a dependent claim, adding detail limitations to claim 1, the amendment separates these means as “x preload means” and “y preload means.”

vi. Claim 7 has been amended to make it further dependent on Claim 6 and to respond to the Examiner’s concerns about the relationship of the yaw

shaft and the vacuum channel means.. The amendment limits Claim 7 to separate x preload and y preload as in Claim 6. The amendment also eliminates confusion as to "...vacuum channel means juxtaposed with said yaw shaft." Yaw shaft 8, identified in Fig. 1, Airflow related to the vacuum is in the channel pattern 23 surrounding the centrally-located yaw shaft 8. and the archipelago of diffuser plate support islands 14 in the yaw vacuum diffuser bracket 5. Vacuum diffuser plate support islands 14 provide hard supports; the relief 25 locates vacuum diffuser plate 7 against x or y motion and locates its top surface as an apron coplanar with the top surface of yaw vacuum diffuser bracket 5, and the vacuum airflow is through vacuum diffuser plate 7, around vacuum diffuser plate support islands 14 and through yaw shaft 8 into a vacuum source which preferably is the vacuum of the moving platform of the stage.

vii. The "peripheral channel" in claim 8 has been renamed by amendment the "peripheral vacuum diffuser plate relief" to eliminate confusion, and is now designated by reference character 25.

viii. Epoxy cement is now shown as smears 24 atop representative positions of the peripheral vacuum diffuser plate locating relief 25 diffuser plate support island among the archipelago of such islands including diffuser plate support island 14 in Fig. 2.

ix. The Examiner is asked to withdraw any concerns about the “high-flatness rigid plate” of Claim 8, line 13. Vacuum diffuser plate 7 is such a “high flatness rigid plate” of claim 8. This is described, among other descriptions, at page 7, line 6 and following, under the heading “Manufacture.” The designation “7” has been added to the term “vacuum diffuser plate” in page 7, line 8, and its characteristics are stated as follows: “Vacuum diffuser plate 7 is of rigid micropore material, ground and polished for flatness.” In Step 3, the yaw vacuum diffuser bracket 5, with the vacuum diffuser plate 7 loosely in place, is inverted and placed upon a flat surface and joggled to planarize them together as the epoxy cement 24 sets.

Since claim 8 is a product-by-process claim directed to the method of manufacture, the Examiner is asked to accept this terminology as properly descriptive of what, at this early stage of manufacture, has not yet become final planarization of vacuum diffuser plate 7 with the yaw vacuum diffuser bracket 5.

All drawing corrections are included in the substitute sheets 1, 2 & 3 of drawings, which the Examiner is asked to approve. Except for the addition of the precision stage 19 and its surface 21, shown in dashed lines as context (not positively stated as an element in any claim) in Fig. 2, all changes are additions of reference numerals to identify items already shown in the figures and already referred to in the text. These changes place the patent application in full compliance with all rules requiring placement and identification in the figures of items previously described elsewhere in the written description and claims – thus no “new matter.”

The term “high resolution” should not be confusing. Because of the relative costs of a positioning stage and optical components, and the general desire for high resolution, it is common to seek resolution mechanically, optically

and electronically for best product. Current capability of mechanical positioning, even “high resolution,” is generally less than resolutions available in optical and electronics devices, so even a high resolution stage may be used as a rough positioner in microlithographic systems. The expected primary use for this invention is as a removable substrate chuck for use with a high resolution stage, in a microlithographic system which typically has limited vertical clearance because of realities of bridge construction and optical path length limitations. The substrate chuck of this invention can, however, be used elsewhere, for example with a different stage which might not be properly referred to as “high resolution” as stage technology continues to improve during the entire lifetime of this patent.

Response to Paragraph 4 -- **Claim Objection**

4. The Examiner is asked to withdraw the basis objection. Claim 2 already has proper antecedent basis for “...said top plane...” because the top plane was listed in Claim 1, line 16 (the first line of clause g of parent Claim 1). The theme of this is to have the entire top surface of the substrate chuck be

coplanar to provide an optimum support surface for the portion of the substrate to be placed on the substrate chuck for action. This is not a surprising theme, but it requires care in providing coplanarity to vacuum diffuser plate 7 and its supporting apron formed by diffuser plate bracket 5.

Response to Paragraphs 5-9 -- ***Section 112 Concern of Indefiniteness***

5,6. These paragraphs state and cite 35 USC 112, the statutory authorization for rejection based upon indefiniteness. No specific response is required.

7. The Examiner is asked to withdraw the indefiniteness objection to Claim 1 in view of amendments made and these remarks. The quoted statement "...with support islands and peripheral channel having a depth appropriate for holding a vacuum diffuser plate flush with said support plane," while arguably correct, is admittedly confusing. By amendment, Claim 1 is changed as follows:
--with diffuser plate support islands (14) and peripheral [channel] vacuum diffuser plate locating relief (25) having a depth appropriate for supporting the

bottom surface of a vacuum diffuser plate (7) with its top surface flush with the apron formed by the top surface of said yaw diffuser plate bracket (5) as an extended substrate carrier [said] defining a substrate support plane,”

The yaw vacuum diffuser plate bracket 5 thus forms an apron about the vacuum diffuser plate 7 with their tops coplanar. It is expected that the substrate in some situations may be significantly larger even than the apron formed by the yaw vacuum diffuser bracket 5. Typically the substrate will be repeatedly repositioned on the vacuum diffuser plate 7 during processing. Vacuum applied through the vacuum diffuser plate 7 holds the substrate down against itself and the apron surrounding the vacuum diffuser plate 7.

8. The Examiner is asked to confirm that corrective amendments to Claim 1 also correct dependent claims 2-6., and that small amendments to terminology made to various claims eliminates confusion of terms. In particular, the term “the peripheral vacuum diffuser plate locating relief 25” about the opening in yaw vacuum diffuser plate bracket 5 now appears should eliminate confusion between the substrate support plane at the top surfaces of yaw

vacuum diffuser plate bracket 7 and vacuum diffuser plate 7 and the plane of the bottom surface of vacuum diffuser plate 7,

9. The Examiner is thanked for exposing to scrutiny the error in Claim 8 related to the coplanarity of the top surfaces of yaw vacuum diffuser plate bracket 7 and vacuum diffuser plate 7. This error is corrected by this amendment; the Examiner is asked to accept Claim 8 as amended. As filed, Claim 8 was confusing as to the location of the substrate support plane at the top of vacuum diffuser plate 7 as contrasted to the plane of support for the bottom surface of vacuum diffuser plate 7. Vacuum diffuser plate 7 is supported by the tops of vacuum diffuser plate support islands 14 and the ledge formed by the peripheral vacuum diffuser locating relief 25 in the yaw vacuum diffuser plate bracket 5. Counsel acknowledges this error, but suggests that Figure 3 is not the best source of correction. Figure 3 does not show the vacuum diffuser plate 7, which is critical in locating the substrate for action. Figure 1 is a much better presentation of the relationships of elements 14 and 26 which form a base supporting vacuum diffuser plate 7. Figure 1 is also much better in showing that the top surfaces of elements 5 and 7 are coplanar in substrate support plane..

Note that there is no element in the claims called "...substrate support bracket." Note also that the substrate itself is not an element in any claim, but rather is inferentially recited in the claims as the item acted upon. The relationship between substrate per se and substrate chuck is that of item carried and carrier.

Interim Summary

This Response has so far dealt with matters of compliance to rules of presentation in figures, written description and claims. Counsel apologizes for the errors.

Applicant and counsel have made a sincere effort to correct all deficiencies. Utility has been shown, and counsel represents that this amendment provides current proper presentation. This leaves the issue of novelty, with the subissue of inventive merit defined in the claims.

Response to Paragraphs 10-11 -- **Section 102 Concern of Anticipation**

10. This paragraph states the requirement of novelty and requires no response.

11. All claims stand rejected on ground of anticipation by Hunter US 6,756,751. The Examiner is asked to reconsider this ground of rejection and withdraw all rejections based on anticipation.

It is no reflection against Hunter to state that his sophisticated invention, which he refers to as a “manipulator,” is quite different from this invention and that the difference is so great that both are patentable. Hunter shows a six-degree-of-freedom positioner, by which he intends to focus and planarize a semiconductor wafer. Hunter features a basket and a significant array of actuators for positioning a chuck. Figures 1-8 and 13 of Hunter are representative, with Figure 6 being demonstrative of the basket and Figure 8 being representative of the chuck 10. The basket, which Hunter calls “housing. 12” has kinematic locators 66 and actuators 18, 20 and 22 to position a the relatively simple chuck 10, which Hunter calls “substrate holder.” Hunter provides sophisticated electronics to control the several actuators, and depends

on housing 12 to position the chuck 10. Hunter at Column 10, lines 23-24 identifies "...the substrate holder or chuck 10 with lift pins 14..." Hunter also specifies annular vacuum rings in chuck 10 for holding variably sized wafers or for dealing with warped wafers. (Column 10, lines 23-36)

Hunter's housing 12 provides sophisticated actuation to his relatively unsophisticated chuck 10. (See, for example, Column 14, lines 27-50, *passim*)

In summary, Hunter provides a sophisticated housing 12 and controls to position his chuck, to provide what Hunter calls a "surface handler" for a wafer (substrate) Hunter does not provide a simple, relatively low-cost, low-profile substrate chuck as shown, described and claimed here In Claim 1 as amended, Hunter does not do what the preamble requires, because he does not provide a substrate chuck for mounting to the vacuum-equipped movable platform of a stage for multi-exposure projection lithography on a substrate of greater area than the area of the substrate chuck.

The preamble of course is not the part of the claim that really matters, except to provide classification and point out the utility. Claim 1 of this patent application, however, quite vigorously amplifies the preamble with nine clauses a through i. Of these nine clauses, every one specifies at least one element or relationship which differentiates from Hunter, as follows:

- a) Hunter has no x-bracket or equivalent in the chuck 10.
- b) Hunter has no x-bracket adjustment means in the chuck 10, but rather uses actuators associated with the housing 12 to adjust the position of the entire chuck 10.
- c) Hunter has no slideway.
- d) Hunter has no y, theta bracket in chuck 10, and of course noting related to the slideway..
- e) Hunter has no equivalent to the yaw shaft or yaw shaft opening.
- f) Hunter has no y-bracket adjustment means in his chuck 10.
- g) Hunter has no configured yaw vacuum diffuser bracket, and of course no top surface defining any apron, and has no support islands, and has

no peripheral vacuum diffuser locating relief 25, and no apron providing extended coplanar support beyond the substrate chuck.

h) Hunter has no vacuum diffuser plate, mounted to any vacuum diffuser bracket. (Note that Hunter's chuck 10 may have some vacuum diffusion means related to the annular rings, and such vacuum diffusion is known.) .Hunter does not mention any requirement for extreme flatness, and indeed uses the annular rings of his chuck 10 to compensate for warping of the wafer. Hunter does not provide any equivalent to the islands 14 and relief 26 to achieve such flatness.

i) Hunter has no adjustment means included in his chuck 10, but depends upon adjusters in housing 12 and elsewhere to move the entire chuck 10.

Response to Paragraphs 12-13 -- **General Information & Conclusion**

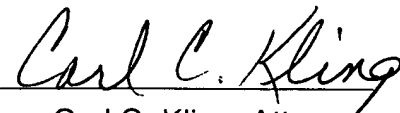
12. The Examiner is thanked for the listing of the prior art made of record and not relied upon.

13. The Examiner's advice concerning communications is appreciated.

Counsel has made a serious review of this patent application, including drawings, written description and claims. Amendments have been made where appropriate, both as corrections and to improve text and claims. A new claim, Claim 10, has been added which is believed to be both simpler and more descriptive of the inventive merit, as well as differentiating from Hunter and other prior art. Reconsideration and allowance of Claims 1-10 are requested.

Respectfully submitted,

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DRAWING AMENDMENTS

Appendix

ANNOTATED MARKED-UP DRAWINGS

1/6

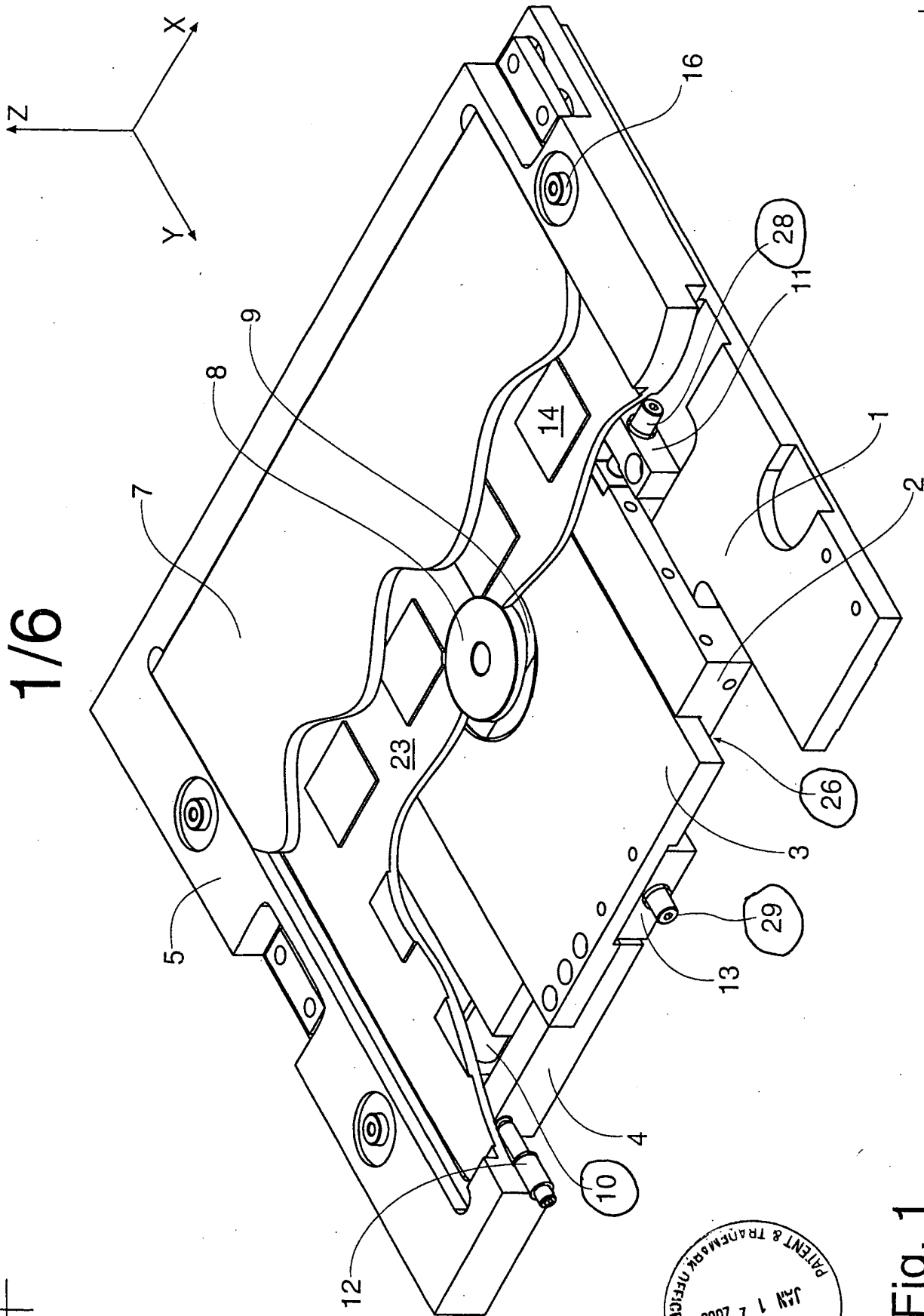


Fig. 1



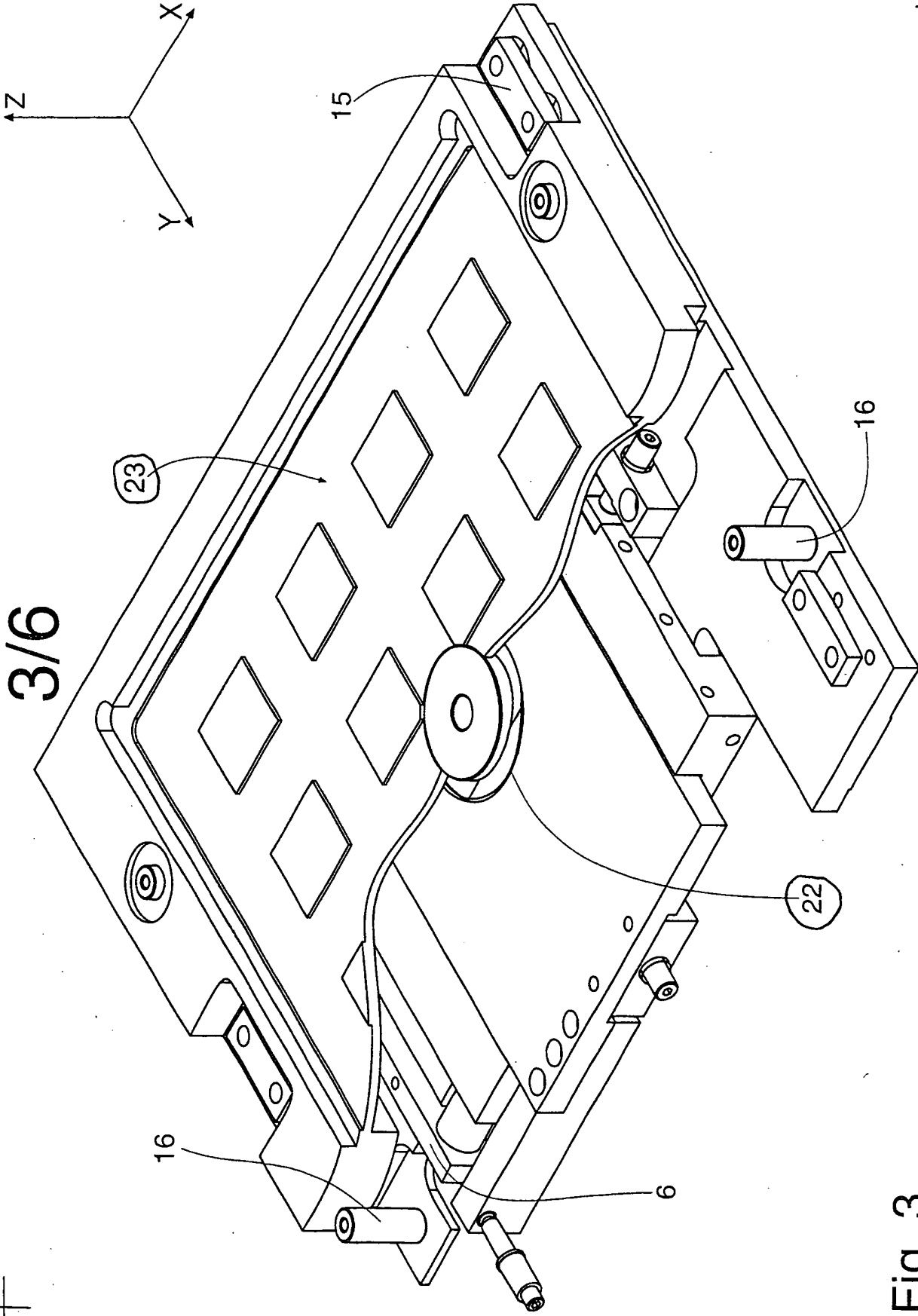


Fig. 3

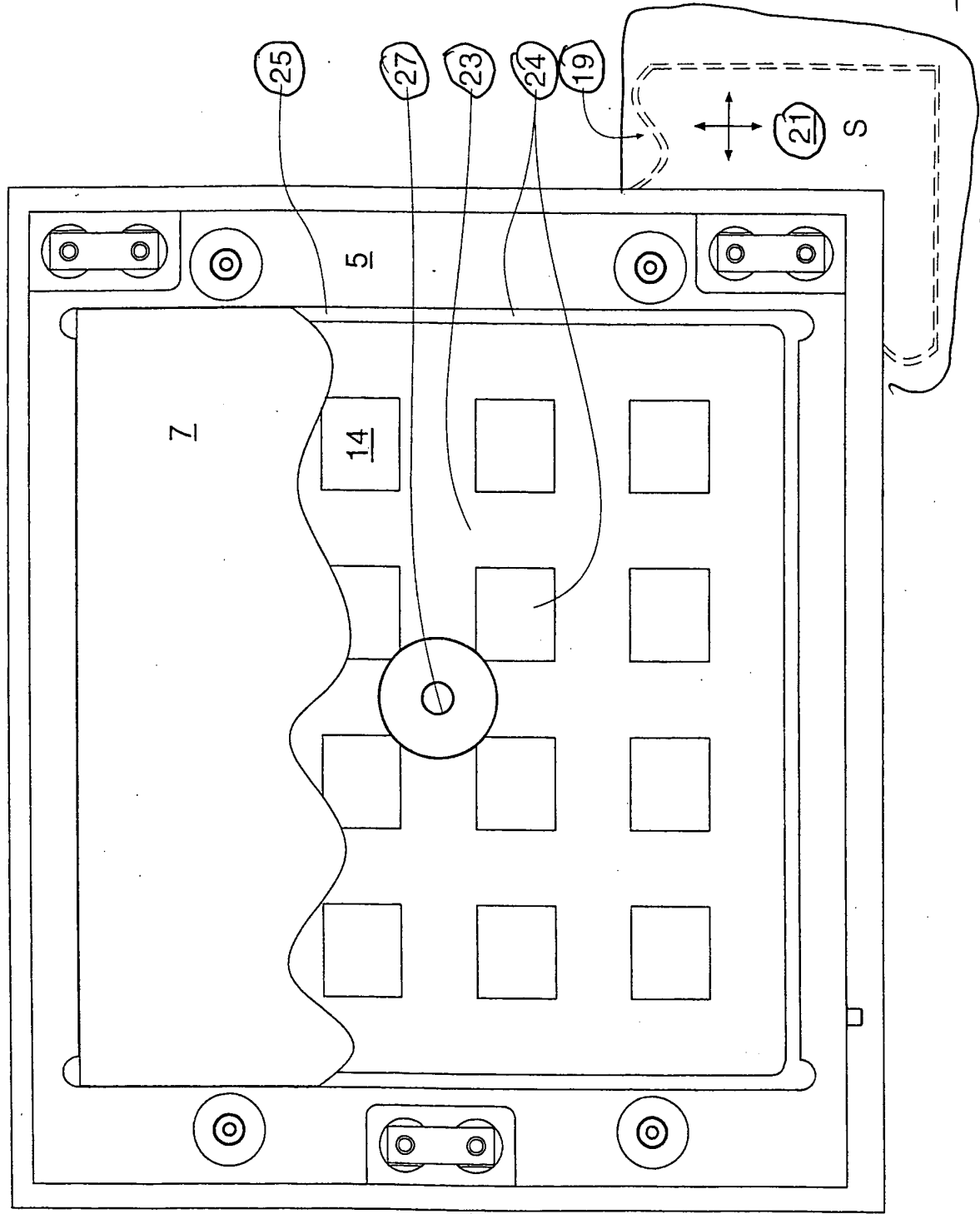


Fig. 2